acontis technologies GmbH

SOFTWARE

EC-Simulator

Python Programming Interface

Version 3.2

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Contents

1 Introduction

The Python Wrapper provides a Python interface to use EC-Master, EC-Simulator and RAS Client/Server.

1.1 Requirements

Python v3.7 and above

- Python Pause. Required for ticked timing with pause.until(…) to lower JobTask's drift, e.g. for Distributed Clocks

  ```
  $ pip install pause
  ```

- PyQt5 (v5.15.1). Only required to run the GUI demo

  ```
  $ pip install pyqt5
  ```

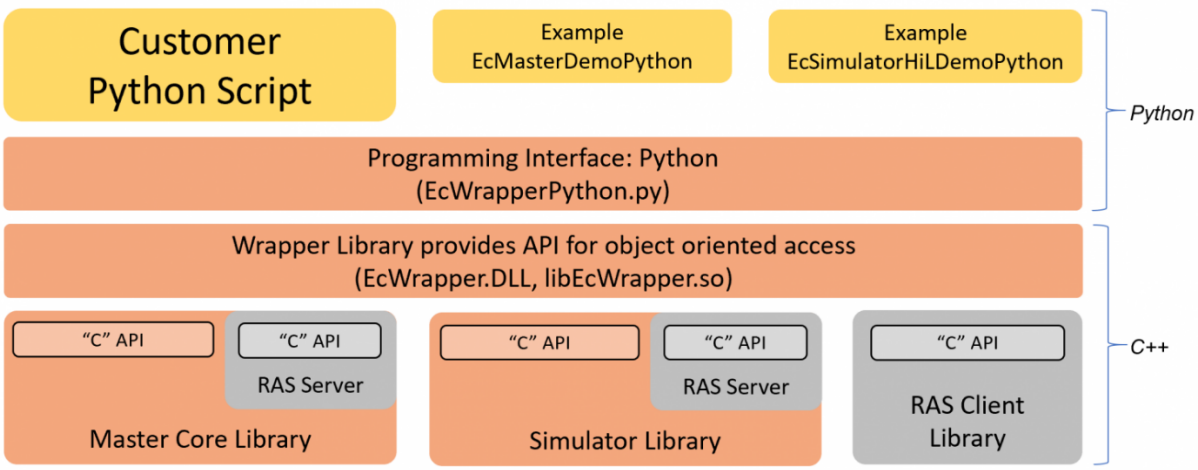
Windows (x86/x64)

- Microsoft Windows 7 and above
- Microsoft Visual C++ 2010 Runtime

Linux (x86/x64/ARM)

- Ubuntu 12.04 and above

1.2 Architecture



The architecture contains 4 basic layers:

Customer Python Script or our examples (EcMasterDemoPython, …)

- Demo application, written in Python

Programming Interface (EcWrapperPython)

- Provides an object oriented API written in Python

Wrapper Library (EcWrapper)

- Native wrapper library, which provides API for object oriented access

Native Libraries

- Master Core Library
- Simulator Library
- RAS Client Library

2 Programmers Guide

2.1 Sample Scripts

There are currently 2 scripts available:

`EcMasterDemoPython.bat`
Starts the console demo application

`EcMasterDemoPythonInteractive.bat`
Starts the interactive demo application

The scripts will start the demo application. The interactive demo application waits for user input where the user can enter the following commands:

```
# Write variable
demo.processImage.variables.Slave_1005__EL2008_.Channel_1.Output.set(1)

# Read variable
demo.processImage.variables.Slave_1005__EL2008_.Channel_1.Output.get()

# Print properties of variable
demo.processImage.variables.Slave_1005__EL2008_.Channel_1.Output.dmp()

# Stop the demo:
demo.stopDemo()
```

2.2 Sample Code

The Python demo application contains of 3 modules:

`EcDemoApp.py`:
Console demo application

`EcDemoAppGui.py`:
Gui demo application, based on Qt5

`EcDemoAppInteractive.py`:
Interactive demo application

2.3 Wrapper

2.3.1 Modules

The Python Wrapper contains of 4 modules:

`EcWrapperPython.py`

`class CEcWrapperPython`
EC-Wrapper base class

`class CEcMasterPython`
EC-Master

`class CEcMasterMbxGatewayClientPython`
Mailbox Gateway Client for EC-Master

class CEcMasterMbxGatewayServerPython
Mailbox Gateway Server for EC-Master

class CEcSimulatorPython
EC-Simulator

class CEcSimulatorRasServerPython
RAS Server for EC-Simulator

class CEcRasClientPython
RAS Client for EcMaster / EcSimulator

EcWrapperPythonTypes.py
Python types

EcWrapper.py
CPython interface (internal)

EcWrapperTypes.py
CPython types (internal)

2.3.2 Return code vs. exception handling

The most of all API functions returns a return code for error handling. This behaviour can be changed to throw an exception in error case by simply setting:

```
CEcWrapperPython.EnableExceptionHandling = True # default is False
```

2.3.3 API with "out" or "ref" parameters

The Python Wrapper API is based on C# code. C# supports `out` and `ref` keywords for parameters. This is not supported in Python and is solved by simply submitting `CEcWrapperPythonOutParam` or `CEcWrapperPythonRefParam` to those functions:

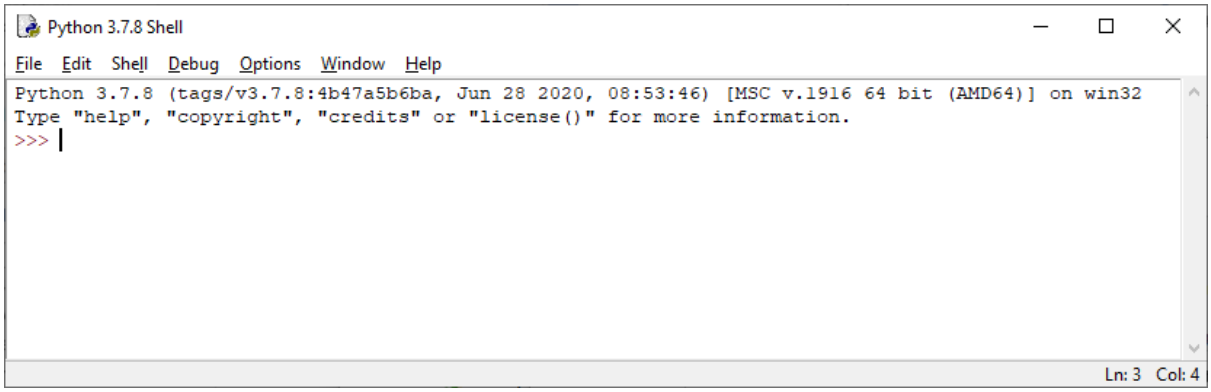
```
# This function has an "out" parameter "out_oSbStatus"
def GetScanBusStatus(self, out_oSbStatus):
    # ...
    return

# Create "out" parameter
out_oStatus = CEcWrapperPythonOutParam()
# Call function
pythonWrapper.GetScanBusStatus(out_oStatus)
# Get the "out" parameter value
oStatus = out_oStatus.value
# Now, the "oStatus" object can be used
print(oStatus.dwResultCode)
```

2.4 Supported IDEs

2.4.1 Python Shell IDLE

This is the default IDE.

It can be started from Windows Start Menu or by calling `C:/Python/Lib/idlelib/idle.py`:



In this shell, the user can simply copy&paste the sample code from: `Examples/EcMasterDemoPython/EcDemoAppInteractive.py`

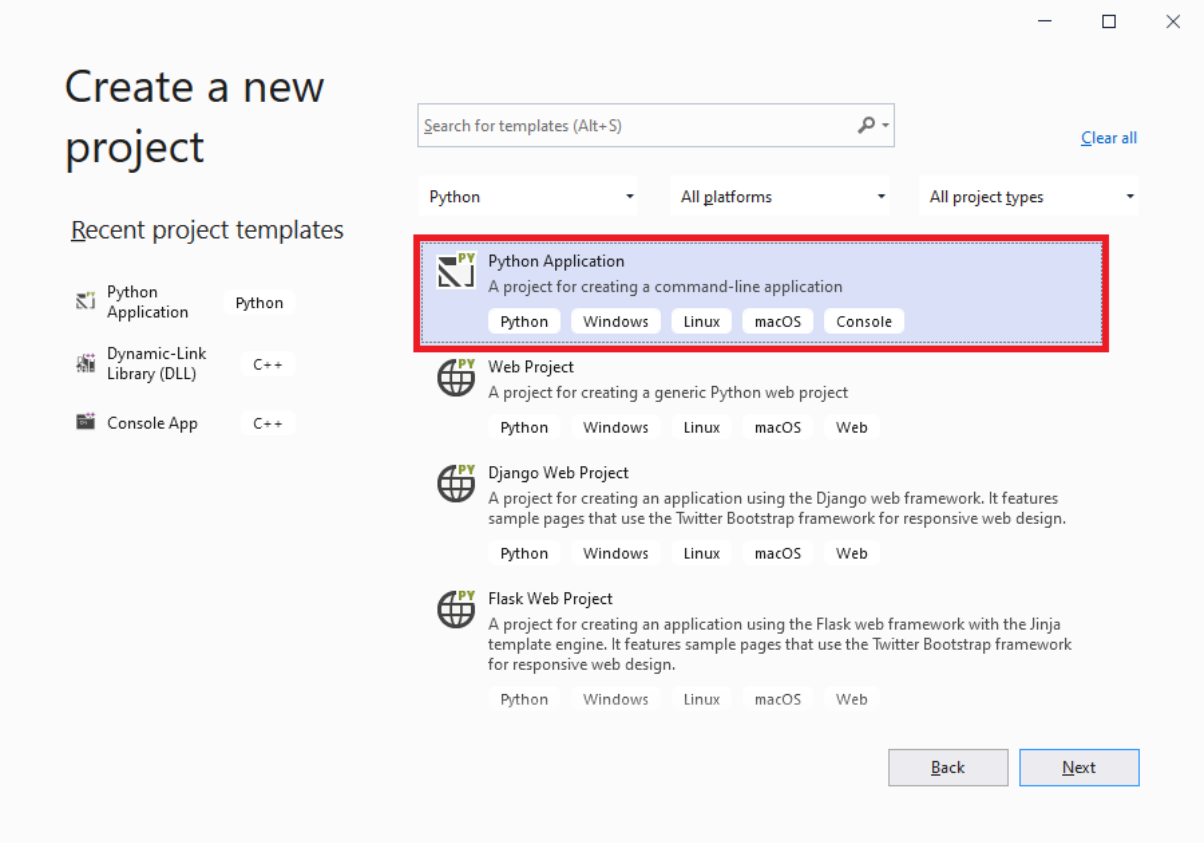
```
exec("""
import os
import sys
INSTALLDIR = "C:/Program
Files/acontis_technologies/EC-Master-Windows-x86_64Bit/"
os.environ["PATH"] += os.pathsep + INSTALLDIR + "Bin/Windows/x64"
sys.path.append(INSTALLDIR + "Sources/EcWrapperPython")
sys.path.append(INSTALLDIR + "Examples/EcMasterDemoPython")
from EcDemoApp import \*
demo = EcMasterDemoPython()
demo.pAppParms.tRunMode = RunMode.Master
demo.pAppParms.dwBusCycleTimeUsec = 4000
demo.pAppParms.szENIFilename = "ENI.xml"
demo.pAppParms.szLinkLayer = "winpcap 127.0.0.0 1"
demo.pAppParms.nVerbose = 3
demo.startDemo()
print("EcMasterDemoPython is running.")
print("Type demo.help() for interactive help.")
""")
```

… and the demo is running.

```
Python 3.7.8 Shell
File  Edit  Shell  Debug  Options  Window  Help
Python 3.7.8 (tags/v3.7.8:4b47a5b6ba, Jun 28 2020, 08:53:46) [MSC v.1916 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>> exec("""
import os
import sys
INSTALLDIR = "C:/Temp/EC-Master-Windows-x86_64Bit/"
os.environ["PATH"] += os.pathsep + INSTALLDIR + "Bin/Windows/x64"
sys.path.append(INSTALLDIR + "Sources/EcWrapperPython")
sys.path.append(INSTALLDIR + "Examples/EcMasterDemoPython")
from EcDemoApp import *
demo = EcMasterDemoPython()
demo.pAppParms.tRunMode = RunMode.Master
demo.pAppParms.dwBusCycleTimeUsec = 4000
demo.pAppParms.szENIFilename = "d:/project.xml"
demo.pAppParms.szLinkLayer = "winpcap 172.20.143.181 1"
demo.pAppParms.nVerbose = 1
demo.startDemo()
print("EcMasterDemoPython is running.")
print("Type demo.help() for interactive help.")
""")

EtherCAT network adapter MAC: 64-70-02-04-D9-A3
EcMasterDemoPython is running.
Type demo.help() for interactive help.
>>>
Ln: 25  Col: 4
```

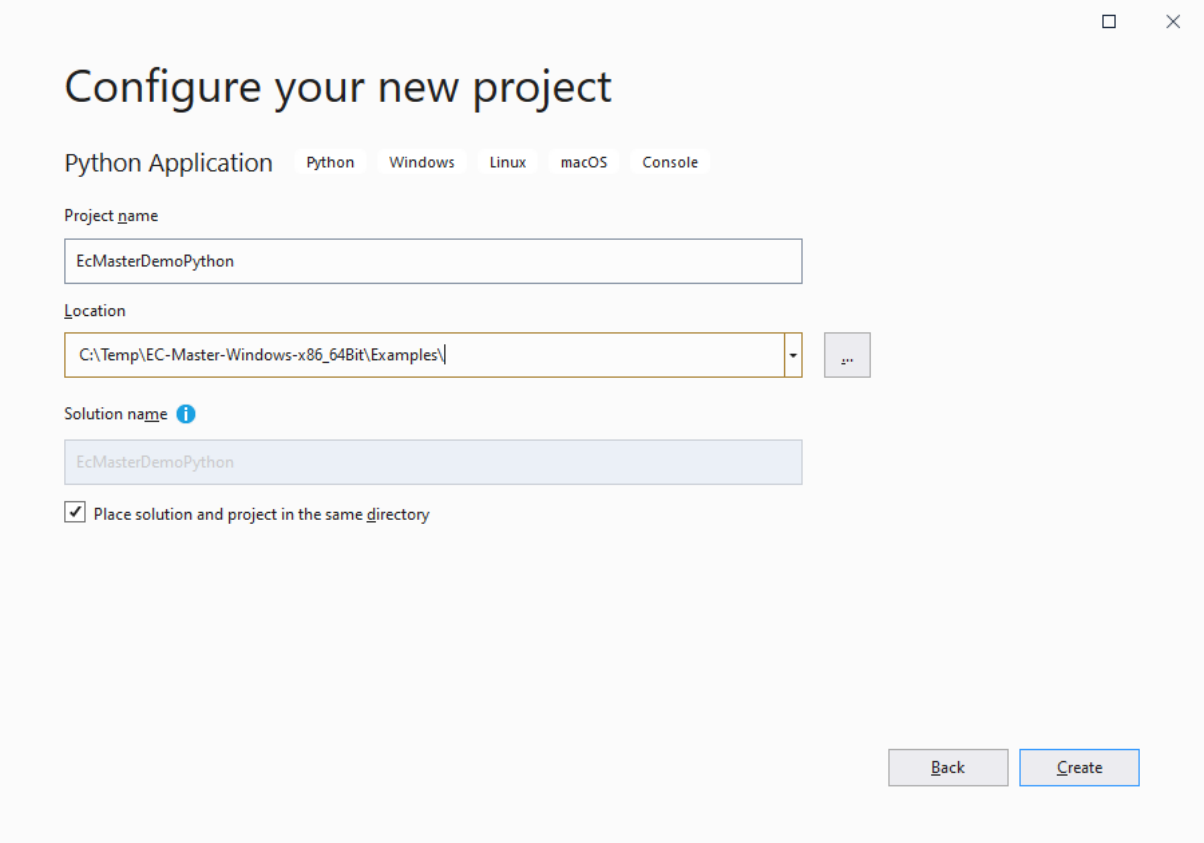
2.4.2 Visual Studio 2019

Create a new project:



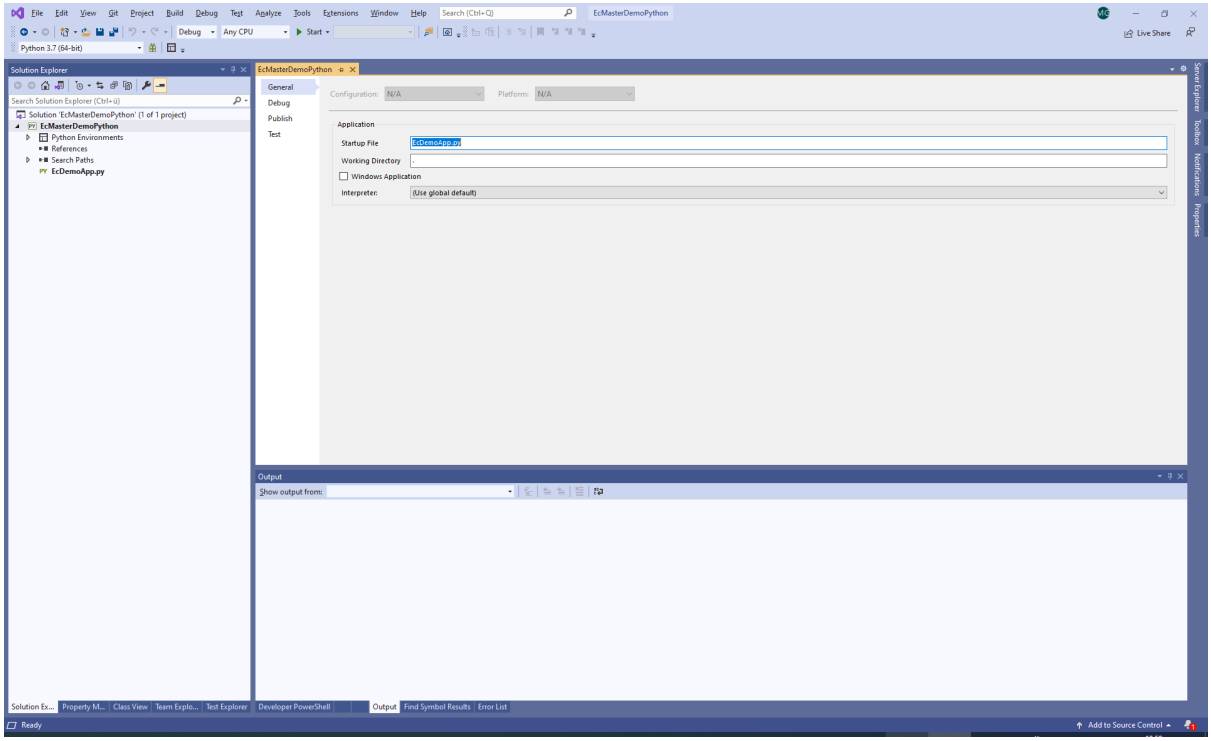
Configure the project:

- Replace the generated file `EcMasterDemoPython.py` with the existing `EcDemoApp.py`.



Configure project *General* settings:

- Startup File: `EcDemoApp.py`



Configure project *Debug* settings:

- Search Paths:

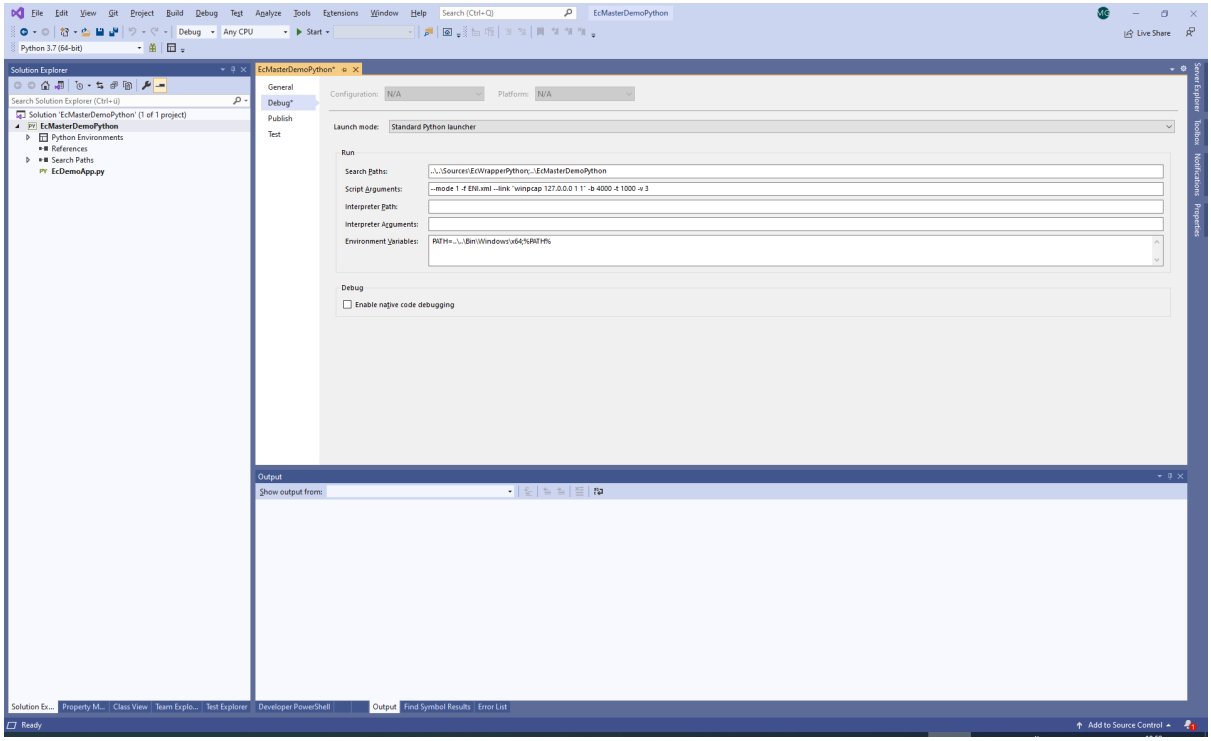
```
../../Sources/EcWrapperPython;../EcMasterDemoPython
```

- Script Arguments:

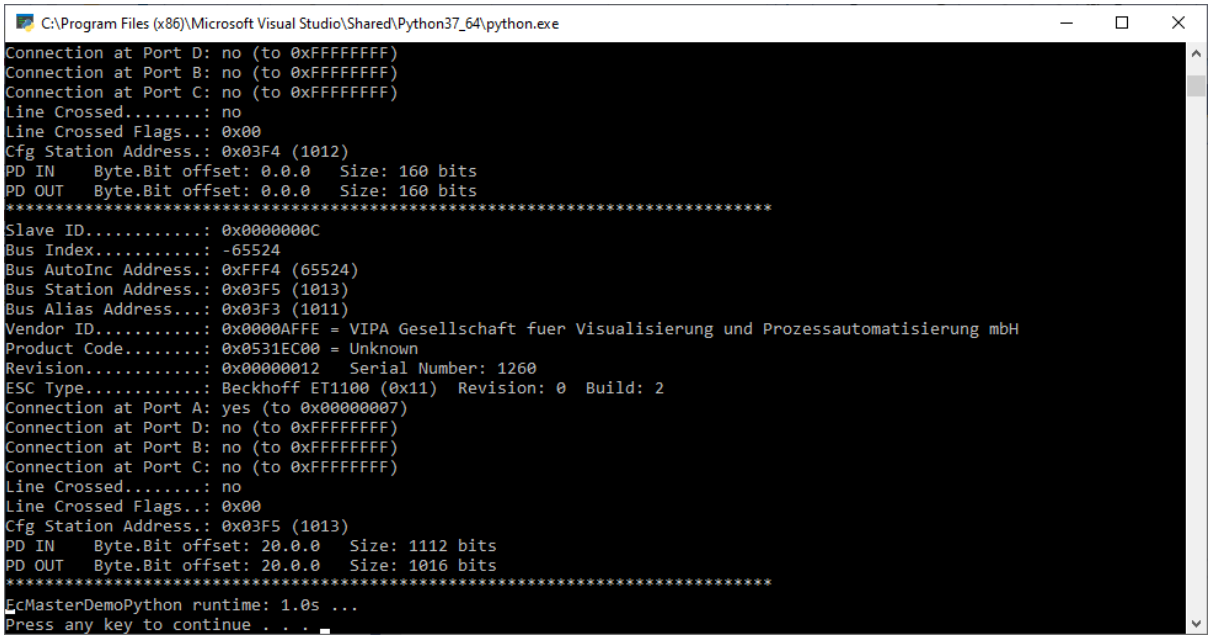
```
--mode 1 -f ENI.xml --link "winpcap 127.0.0.0 1 1" -b 4000 -t 1000 -v 3
```

- Environment Variables:

```
PATH=../../Bin/Windows/x64;%PATH%
```

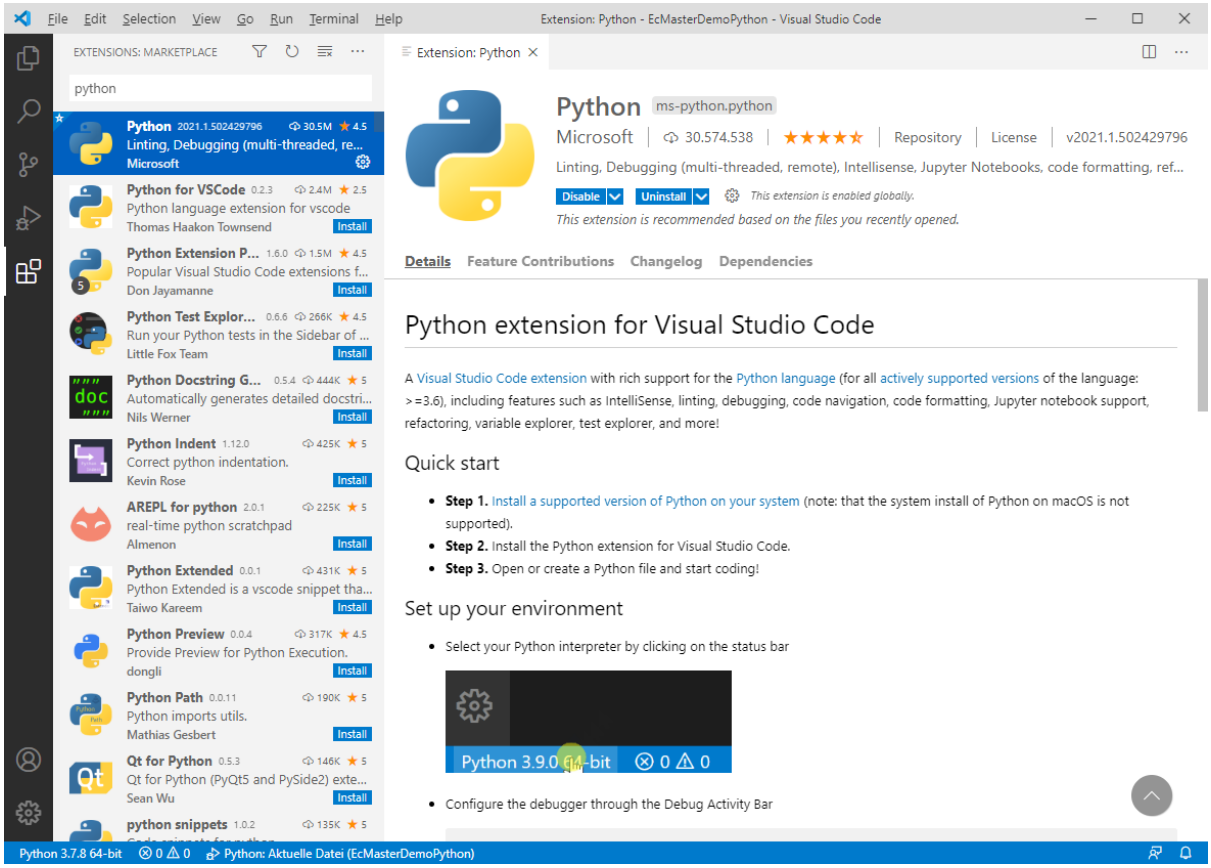


Press *Start* and the demo is running:



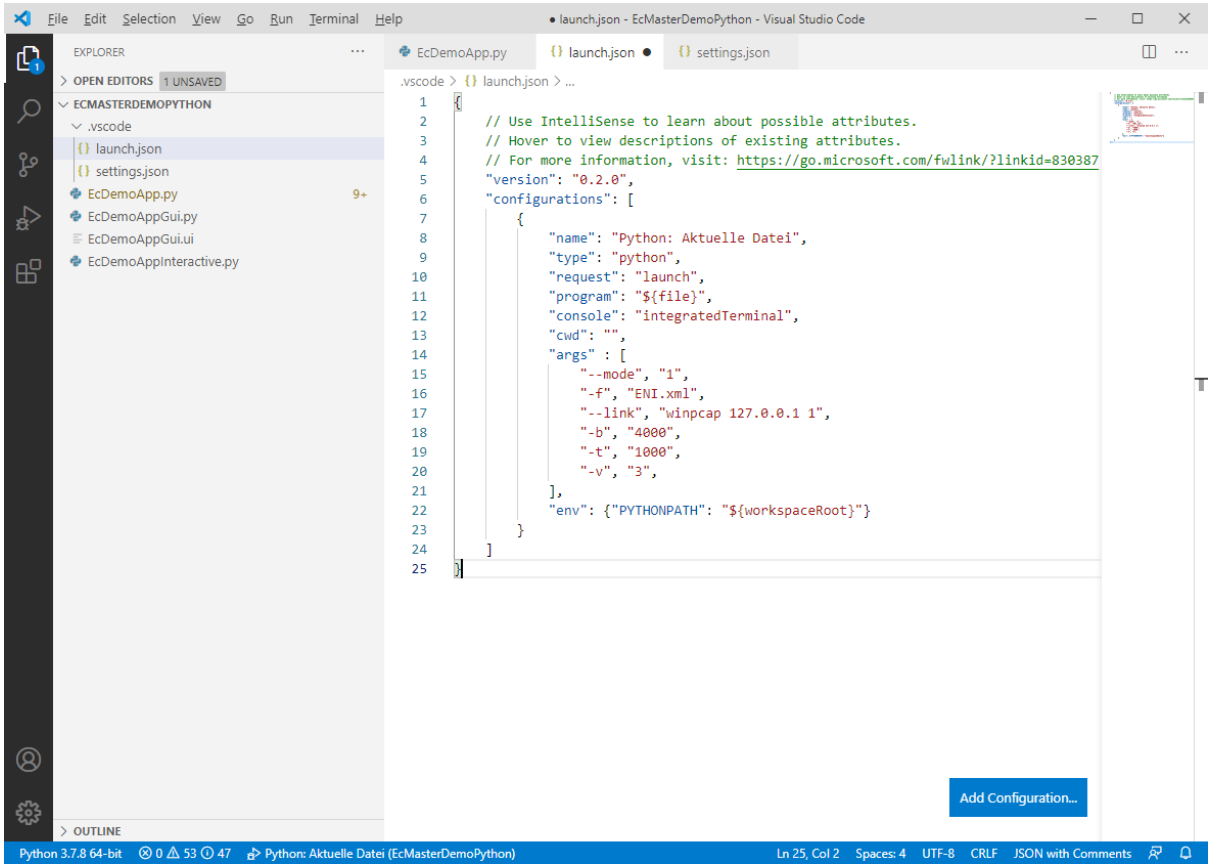
2.4.3 Visual Studio Code

Install python extension by open extension tab and enter *python*:



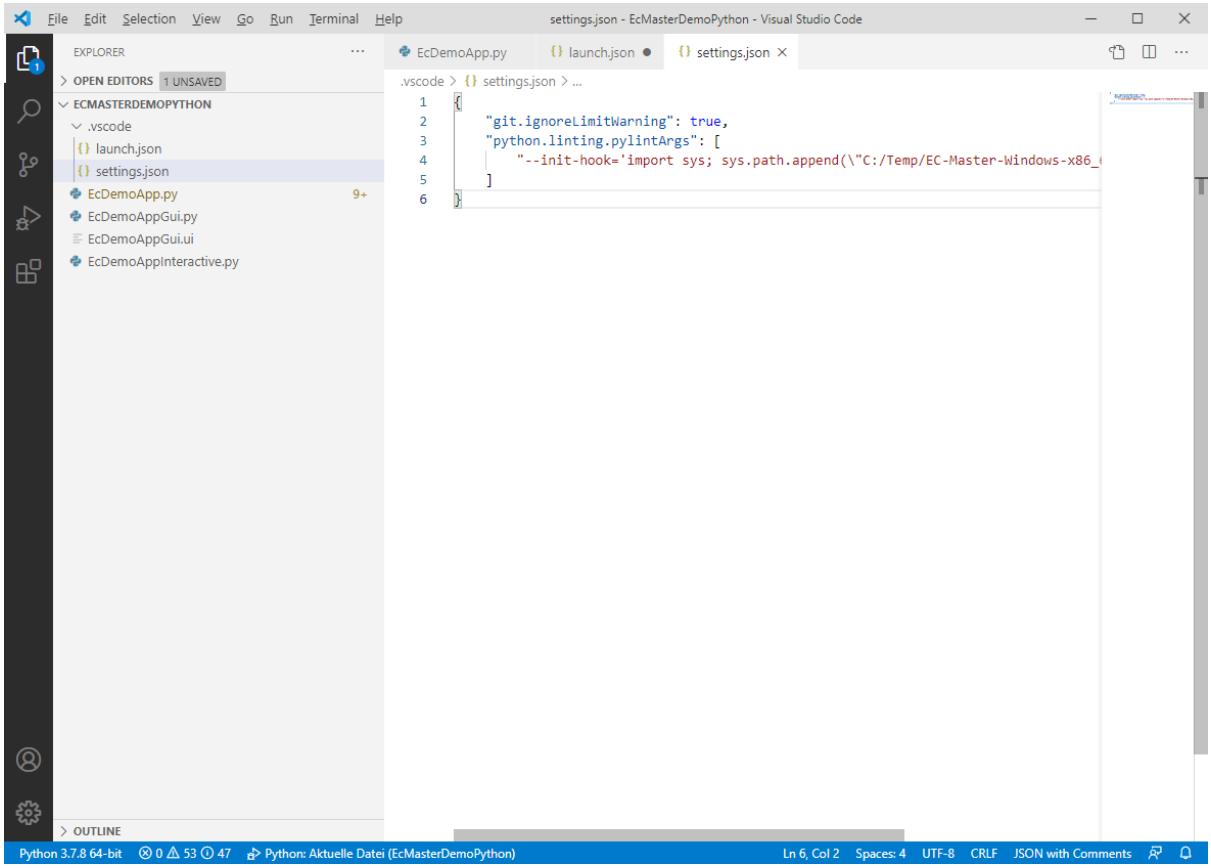
Open folder `Examples/EcMasterDemoPython` and configure the `launch.json`:

```
{
    "version": "0.2.0",
    "configurations": [
        {
            "name": "Python: Aktuelle Datei",
            "type": "python",
            "request": "launch",
            "program": "${file}",
            "console": "integratedTerminal",
            "cwd": "",
            "args" : [
                "--mode", "1",
                "-f", "ENI.xml",
                "--link", "winpcap 127.0.0.1 1",
                "-b", "4000",
                "-t", "1000",
                "-v", "3",
            ],
            "env": {"PYTHONPATH": "${workspaceRoot}"}
        }
    ]
}
```



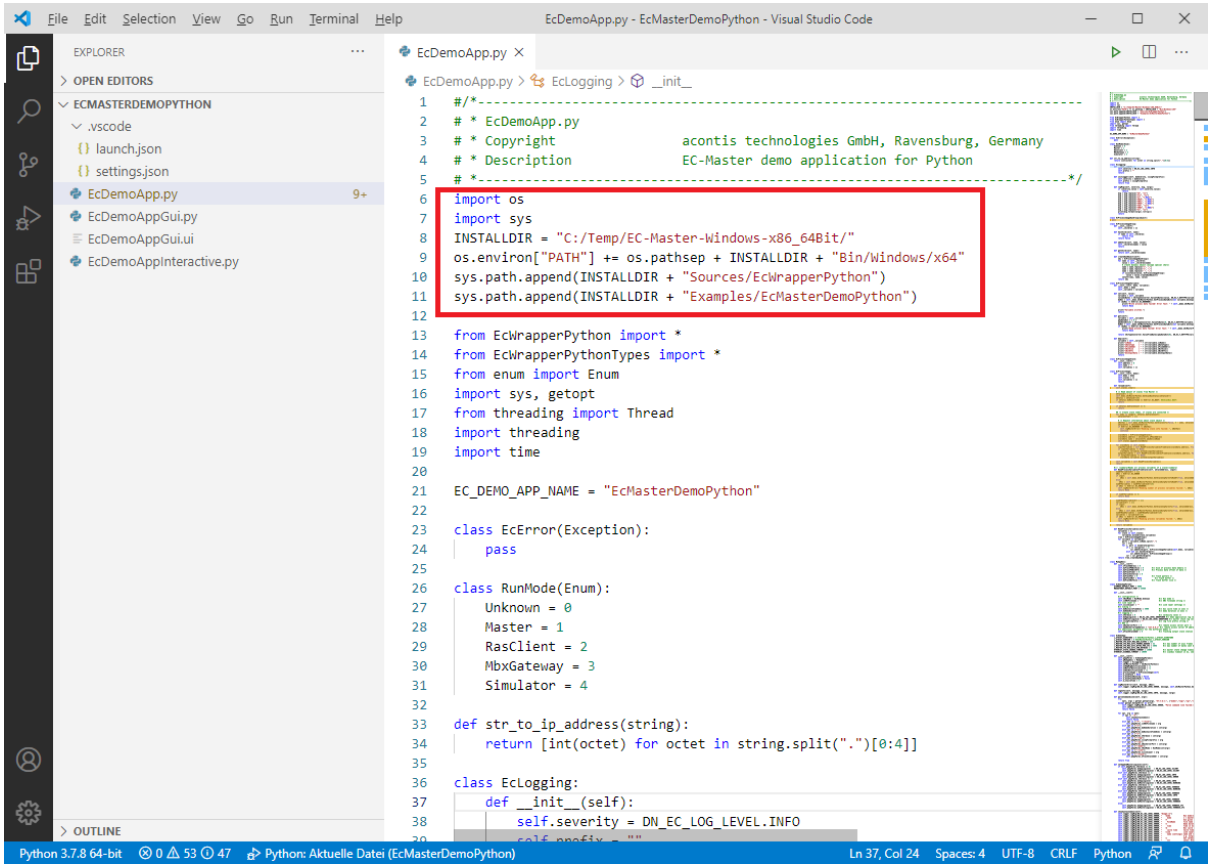
Configure linter in `settings.json`:

```
{
        "git.ignoreLimitWarning": true,
        "python.linting.pylintArgs": [
            "--init-hook='import sys; sys.path.append(\"C:/Temp/EC-Master-
↪Windows-x86_64Bit/Sources/EcWrapperPython\")'"
        ]
}
```

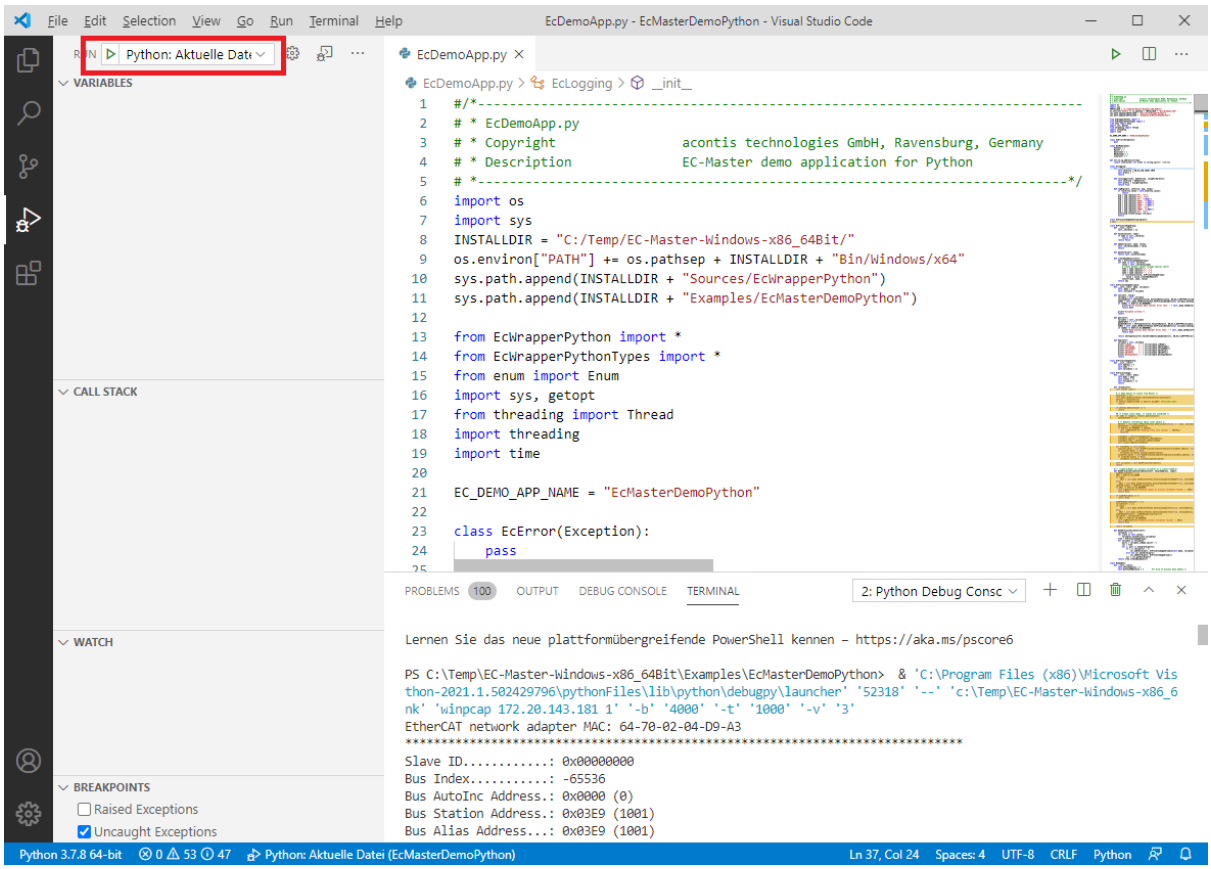


Open `EcDemoApp.py` and the following lines to set environment:

```
import os
import sys
INSTALLDIR = "C:/Temp/EC-Master-Windows-x86_64Bit/"
os.environ["PATH"] += os.pathsep + INSTALLDIR + "Bin/Windows/x64"
sys.path.append(INSTALLDIR + "Sources/EcWrapperPython")
sys.path.append(INSTALLDIR + "Examples/EcMasterDemoPython")
```



Start debugging and the demo output will be written into the terminal:



3 FAQ

PyQt5 cannot be installed on Ubuntu 14.04 x64, because it requires Python 3.5. How can I install it?

It can be installed by calling

```
$ sudo apt-get install python3-pyqt5
```

I installed Python and the demo crashes with strange errors. What can I do?

This might be a problem of mixing x86 with x64 binaries. Verify that if you have installed the Python runtime for x64 bit, please install also EC-Master for x64 bit.